FLUKE 21, 23 Multimeters

Service Manual

FLUKE®

FLUKE
21, 23
Multimeters

Service Manual

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Fluke 21,23
LIMITED WARRANTY

John Fluke Mfg. Co., Inc., (Fluke) warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of 3 years from date of purchase. This warranty extends only to the original purchaser and shall not apply to batteries, fuses, or any instrument which has been subjected to misuse, neglect, accident or abnormal conditions of operation.

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John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett WA 98206

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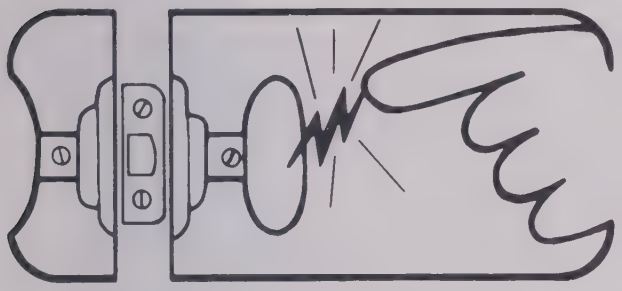
static awareness

A Message From

John Fluke Mfg. Co., Inc.

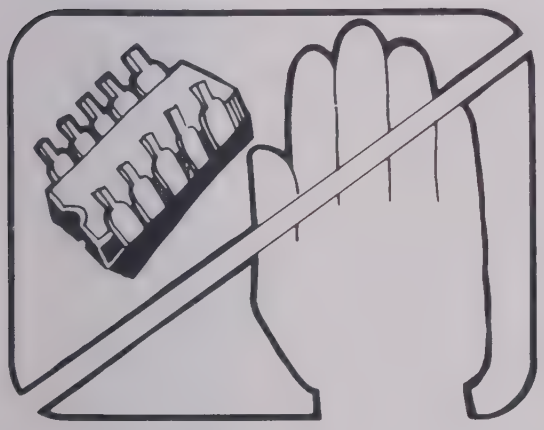


Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

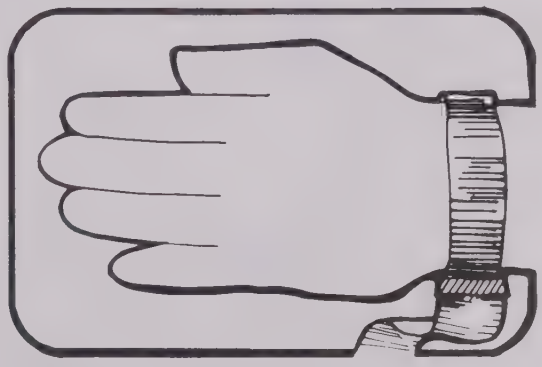
1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol "⊗"

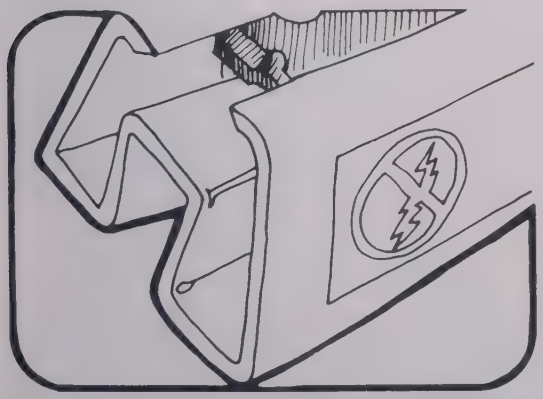
The following practices should be followed to minimize damage to S.S. devices.



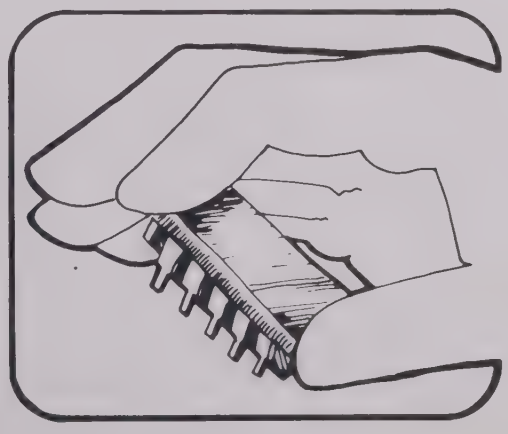
1. MINIMIZE HANDLING



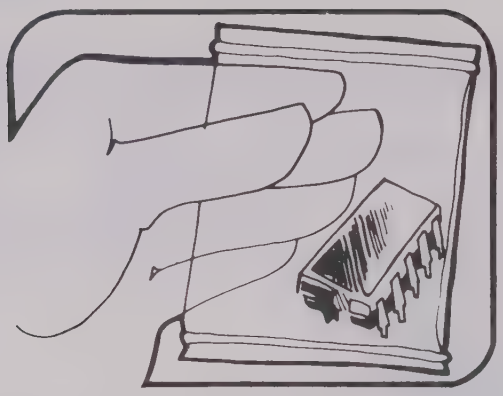
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES



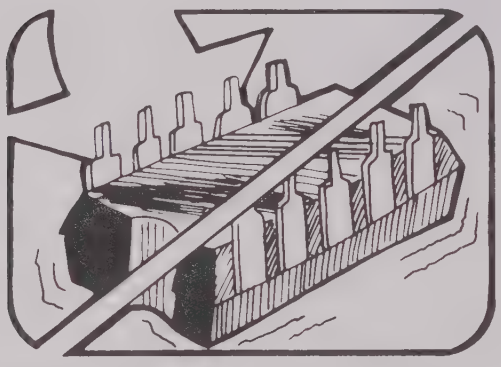
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



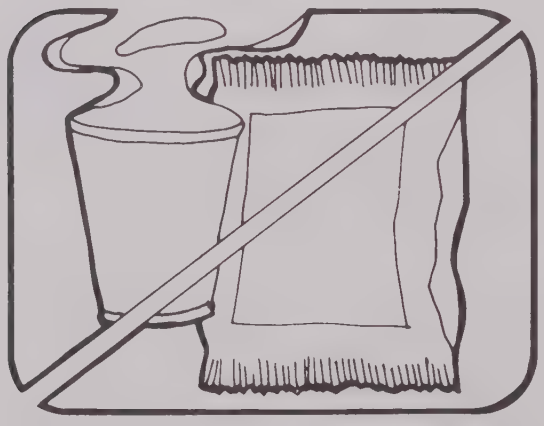
4. HANDLE S.S. DEVICES BY THE BODY



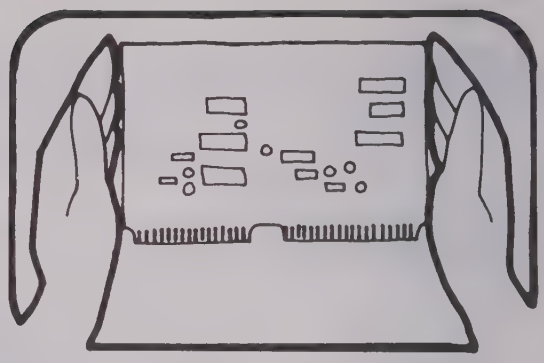
5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



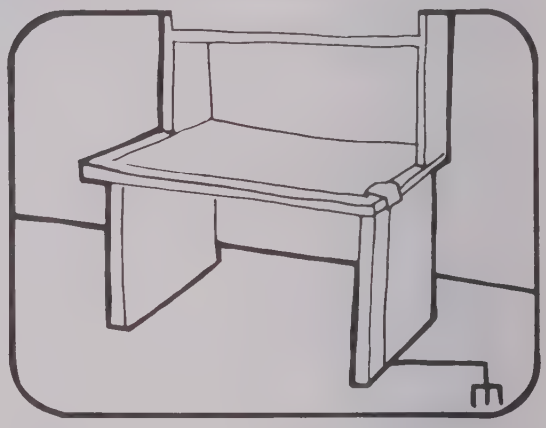
6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE



7. AVOID PLASTIC, VINYL AND STYROFOAM IN WORK AREA



8. WHEN REMOVING PLUG-IN ASSEMBLIES, HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR USUALLY PROVIDES COMPLETE PROTECTION TO INSTALLED SS DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION
10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.
11. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

John Fluke Part No.	Description
453522	6" X 8" Bag
453530	8" X 12" Bag
453548	16" X 24" Bag
454025	12" X 15" Bag
Pink Poly Sheet	Wrist Strap
30"x60"x60 Mil	P/N TL6-60
P/N RC-AS-1200	$7.00
$20.00	

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Section 1
Introduction and Specifications

1-1. INTRODUCTION

This manual presents service information for the Fluke 21 and 23 Multimeters. Included are a theory of operation, general maintenance procedures, performance tests, calibration procedures, troubleshooting information, a list of replaceable parts, and a schematic diagram.

1-2. SPECIFICATIONS

For instrument specifications, refer to the Operator's Manual provided with the instrument at time of purchase.

Section 2
Operating Instructions

2-1. INTRODUCTION

For operating instructions, refer to the Operator's Manual provided with the instrument at time of purchase.

Section 3
Theory of Operation

3-1. INTRODUCTION

This section contains a brief overview of the 21 and 23 Multimeters, followed by a more detailed explanation of operation.

3-2. OVERVIEW

The heart of the instrument is made up of a two-chip CMOS system: U1, a primarily analog IC, and U2, a calculator-style microcomputer. (See Figure 3-1.)

The analog chip, U1, contains the A/D converter and additional circuitry for autorange switching and signal conditioning. With most of the analog circuitry on U1, the off-chip signal conditioning is at the simplest possible level. Peripherals to U1 include function switching, voltage reference and the crystal.

The microcomputer, U2, controls the A/D converter function and range switching, reads and formats the A/D samples, and drives the liquid crystal display (LCD).

3-3. DETAILED DESCRIPTION

The following paragraphs describe the 21 and 23 Multimeters in more detail. While reading this description, refer to the schematics in Section 7.

3-4. Input Signal Conditioning

Since the A/D conversion process is essentially a dual slope method, two input voltages are required to complete a measurement cycle. One is the unknown input and the other is the reference voltage.

Conditioned input signals are routed to the A/D in U1, where they are integrated. The reference voltage, developed by reference supply VR1, R15, R16, and R8, is routed to the A/D in U1, where it is used for the de-integrate portions of the measurement cycle.

Input voltage signal conditioning is accomplished with input divider Z1 and dc blocking capacitor C1, with pin 1 of Z1 as the input, pin 3 as the 3.2V tap, pin 4 as the 32V tap, pin 5 as the 320V tap, and pin 6 as the 1000V tap. Overvoltage protection is supplied by E1, E2, R1, R2, and RJ1. E1 and E2 are spark gaps which fire at about 1500V. R1 is a fusible wirewound resistor, and RJ1 is an MOV that clamps overvoltage inputs.

Current input conditioning is achieved by R6, R7, R5, and R13. R6 and R7 develop the input voltage from the applied current, and R5 and R13 act as an input divider for the 300 mA range. F1, F2 and R20 are for overcurrent protection in the mA and 10A ranges.

In the ohms function (Figure 3-2), the unknown resistance at J1 is compared to the reference resistors in Z1. This is accomplished by driving current from the ohms voltage source through the reference resistors and the unknown resistance Rx. The developed voltage drops, V1 and V2, are used for ratiometric ohms conversion within the analog chip U1.

3-5. Ohms Input Protection

(Refer to schematic in Section 7). Input protection for the ohms ranges consists of Q1, Q2, Q3, R2, R3, R4, and RT1. Q1 and Q2 serve as back-to-back zener diodes which limit the input to between 7 and 9V. RT1 is a thermistor which normally has about 1 kΩ of resistance but increases to very high impedance as it heats up upon high overload. Also, R2, R3, and R4 limit current, and Q3 clamps pin 29 of U1 to approximately 2.5V.

3-6. Additional Circuitry

(Refer to schematic in Section 7.) The ratio of R17 and R18 determine ac voltage and current accuracy, and C11 is the averaging capacitor for the ac converter portion of U1.

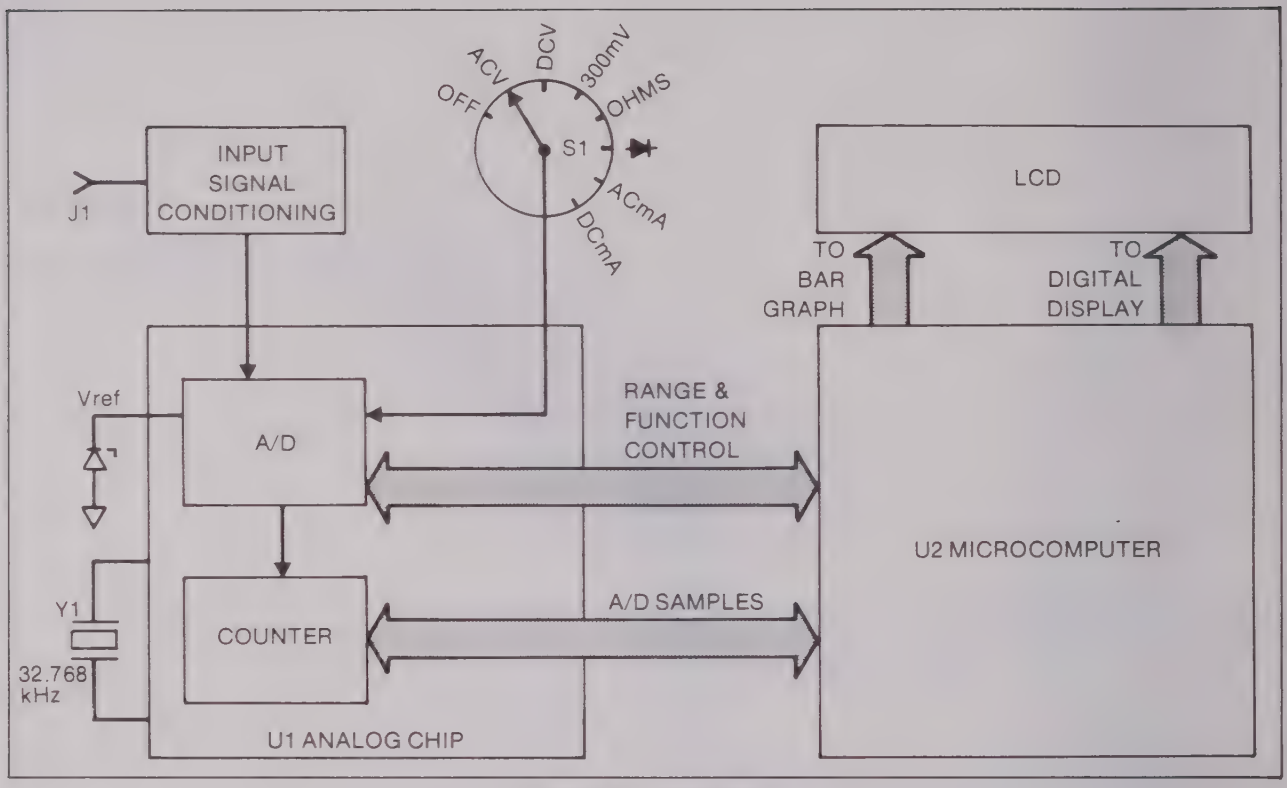


Figure 3-1. Overview

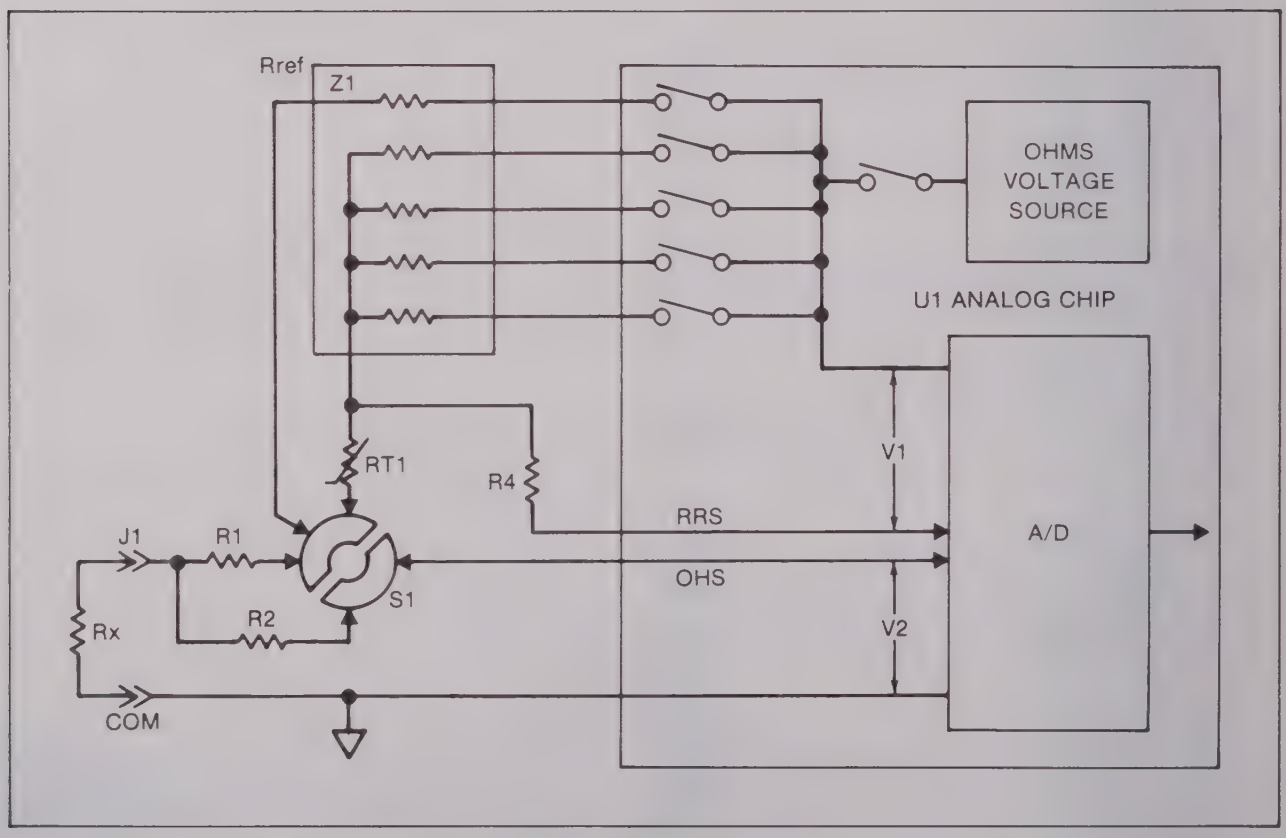


Figure 3-2. Ohms Function

R9, R10, C5 and C6 are part of the active filter located in U1. Conditioned input signals are passed through the active filter in route to the A/D section of U1.

The clock frequency for the digital portion of the circuit is a function of 32.768 kHz crystal Y1. Y1, C12, and amplifiers in U1 make up the oscillator circuit.

C7 stores offsets of the buffer, integrator, and comparator amplifiers of the A/D. The gain of the buffer is determined by the resistors of Z1 between pins 8, 9, and 10. C8 is the integrator capacitor.

Rotary switch S1 FRONT selects and routes the input signals. Function codes for switch S1 REAR are shown in Table 3-1. Range switch S2 signals the microcomputer U2 for the Touch Hold function (23 only) and the Range Hold function (21 and 23).

CR1 acts as protection for U1 if the battery is installed backwards. C2 is part of the power-on reset for microcomputer U2.

Table 3-1. S1 Function Codes

FUNCTION	B0	B1	B2
ACV	1	1	1
DCV	0	1	1
300mV	0	0	0
Ohms	0	0	1
⊣◀)))	1	0	0
ACA	1	1	0
DCA	0	1	0

1 = VDD
0 = ⏚ (Common)

Section 4
Maintenance

WARNING

THESE SERVICE INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATOR'S MANUAL UNLESS YOU ARE QUALIFIED TO DO SO.

4-1. INTRODUCTION

This section contains maintenance information for the Fluke 21 and 23, including performance tests, calibration, general maintenance procedures, and troubleshooting. For operator maintenance and instrument specifications, refer to the Operator's Manual.

The performance tests are recommended as a preventive maintenance tool to verify proper instrument operation. A one year calibration cycle is recommended to maintain the specifications given in the Operator's Manual. Test equipment required for the performance tests and calibration is listed in Table 4-1. If the recommended equipment is not available, instruments with equivalent specifications may be used.

4-2. PWB ACCESS AND GENERAL MAINTENANCE

WARNING

TO AVOID ELECTRICAL SHOCK, REMOVE TEST LEADS BEFORE OPENING CASE, AND CLOSE CASE BEFORE OPERATING METER. TO PREVENT FIRE, INSTALL FUSES WITH RATING SHOWN ON BACK OF METER.

CAUTION

To avoid contaminating the pwb with oil from the fingers, handle it by the edges or wear gloves. PWB contamination may not cause immediate instrument failure in controlled environments. Failures typically show up when contaminated units are operated in humid areas.

Use the following procedure for removing the pwb (printed wire board) from its case:

1. Set the function switch to OFF and disconnect test leads if installed.
2. Remove the four Phillips screws from the bottom cover.
3. Turn the meter face up, grasp the top cover, and pull the top cover from the meter.
4. Lift fuse F2 before removing the Phillips screw that holds the pwb to the back cover. BE CAREFUL NOT TO LOSE THE SPRING LOCATED DIRECTLY UNDER THE SCREW ON THE BACK SIDE OF THE PWB.

5. The pwb may now be removed from the bottom cover.

4-3. DISPLAY ACCESS

CAUTION

Do not handle the conductive edges of the LCD interconnects. If contaminated, clean with isopropyl alcohol.

Refer to Figure 4-1.

1. Remove the four Phillips screws from the back side of the pwb.
2. Remove the LCD mounting bracket.
3. Insert a small screwdriver under the edges of the display holding bracket, and gently pry the bracket loose from the snaps.
4. Turn the bracket upside down to remove the LCD.
5. Before installing a new LCD, make sure that all connector contact points are clean.

4-4. CLEANING

CAUTION

To avoid damaging the meter, do not use aromatic hydrocarbons or chlorinated solvents for cleaning. These solutions will react with the plastics used in the instruments.

Do not allow the liquid crystal display to get wet. Remove the display assembly before washing the PWB and do not install until the PWB is completely dry.

Do not use detergent of any kind for cleaning the PWB.

Do not remove lubricants from the switch when cleaning the PWB.

Clean the instrument case with a mild detergent and water.

The pwb may be washed with isopropyl alcohol or deionized water and a soft brush. Remove the display assembly and fuses before washing, and avoid washing the switch if possible. Dry with clean dry air at low pressure and then bake at 50°C for 24 hours.

Table 4-1. Recommended Test Equipment

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED MODEL
PREFERRED		
DMM Calibrator	John Fluke 5100B Family	John Fluke Models 5100B, 5101B or 5102B
ALTERNATE		
AC Calibrator	Voltage Range: 0-750V ac ± 0.3% Frequency Range: 40-1000 Hz ± 3%	John Fluke Models 5200A and 5215A
DC Voltage Calibrator	Voltage Range: 0-1000V dc Accuracy: ± .03%	John Fluke Model 343A
DC Current Calibrator	Current Range: 2 mA - 2A Accuracy: ± .15%	John Fluke Model 382A
Decade Resistor	Resistance Values: 100Ω, 1 kΩ 10 kΩ, 100 kΩ, 1 MΩ, 10 MΩ, Accuracy: ± .1% Power Rating: 1/8 W	ESI Model DB 62

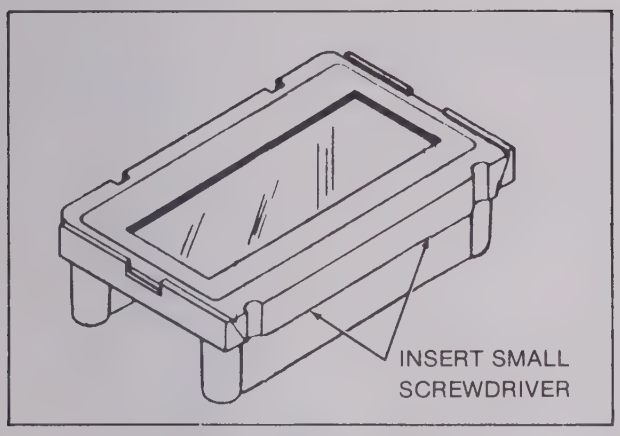


Figure 4-1. Display Assembly

4-5. PERFORMANCE TESTS

Performance tests are recommended for incoming inspection, periodic maintenance, and for verifying the specifications in the Operator's Manual. If the instrument fails any part of the test, calibration and/or repair is indicated.

In the performance tests, the Fluke 21, 23 Multimeter is referred to as the unit under test (UUT).

4-6. Initial Procedure

1. Allow the UUT to stabilize to room temperature 23°C ± 5°C (73°F ± 9°F).

2. Check the fuses and battery and replace if necessary.

WARNING

TO PREVENT FIRE, INSTALL FUSES WITH RATING SHOWN ON BACK OF METER.

4-7. Display Test

To test the display, turn the UUT on and check whether all display segments come on as indicated in Figure 4-2.

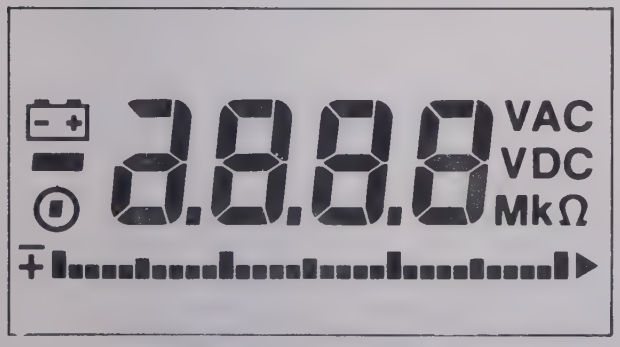


Figure 4-2. Display Test

4-8. AC Voltage Test

WARNING

CONNECT THE GROUND/COMMON/LOW SIDE OF THE AC CALIBRATOR TO COMMON ON THE UUT.

1. Put the UUT function switch to VAC and connect the AC Calibrator to the V-Ohm and Common input terminals.

2. Set the AC Calibrator for the output given in Table 4-2 and verify that the UUT display reading is within the limits shown.

NOTE:

When the input is open in the VAC function, it is normal for the 21, 23 Multimeters to read some counts on the display. This is due to ac pickup in the ac amplifier when the ac amplifier is unterminated.

4-9. DC Voltage Test

WARNING

CONNECT THE GROUND/COMMON/LOW SIDE OF THE DC CALIBRATOR TO COMMON ON THE UUT.

1. Put the UUT function switch to VDC and connect the DC Voltage Calibrator output to the V-Ohm and Common input terminals of the UUT.

2. Referring to Table 4-3, set the DC Voltage Calibrator for the output indicated in steps 1 through 4 only. Verify that the UUT display reading is within the limits shown.

3. Set the DC Voltage Calibrator for an output of +300 mV, and switch the UUT to the 300 mV function. Verify that the UUT display reading is within the limits shown in Table 4-3 (step 5).

4-10. Resistance Test

1. Select the ohms function on the UUT.

2. Connect the Fluke 5100B or Decade Resistor to the V-Ohm and Common input terminals of the UUT.

3. Referring to Table 4-4, set the Decade Resistor or Fluke 5100B to the resistance value indicated in steps 1 through 6. Verify that the display reading is within the limits shown.

4-11. Diode Test

To test the 21 and 23 meters, perform the following steps:

1. Put the UUT in the Diode Test function.

NOTE

On Fluke 5100 series calibrators, activate the 50Ω divider override.

2. Apply an input from the DC Voltage Calibrator of +.090V dc to the V-Ohm and Common input terminals of the UUT and verify that the beeper is on.

3. Increase the DC Voltage Calibrator output to +.110V dc and verify that the beeper is off.

4-12. DC mA Test

1. Set the output of the DC Current Calibrator to zero and connect it to the 300 mA and Common input terminals of the UUT.

2. Set the DC Current Calibrator to the output shown in Table 4-5, and verify that the UUT display reading is within the limits shown.

NOTE

The mA input in the Fluke 23 is protected by F1 and R20. R20 is a fusible resistor that opens when fault voltages greater than 250V are accidentally applied.

4-13. DC Amps Test (23 Only)

1. Set the DC Current Calibrator for zero output and connect it to the 10A & Common input terminals of the UUT.

2. Apply currents as indicated in Table 4-6 and verify the display reading is within the limits shown.

Table 4-2. AC Voltage Test

STEP	INPUT		DISPLAY READING	
	VOLTAGE	FREQ.	21	23
1	2.7V	100 Hz	2.644 to 2.756	2.644 to 2.756
2	2.7V	500 Hz	2.644 to 2.756	2.644 to 2.756
3	750V	100 Hz	733 to 767	733 to 767
4	750V	1000 Hz	733 to 767	733 to 767

Table 4-3. DC Voltage Test

STEP	DC INPUT VOLTAGE	DISPLAY READING	
		21	23
1	+2.7V	2.685 to 2.715	2.691 to 2.709
2	+27V	26.85 to 27.15	26.91 to 27.09
3	+270V	268.5 to 271.5	269.1 to 270.9
4	+1000V	993 to 1007	995 to 1005
5*	+300 mV	298.4 to 301.6	299.0 to 301.0

*300mV function only

Table 4-4. Resistance Test

STEP	INPUT RESISTANCE	DISPLAY READING	
		21	23
1	100Ω	99.1 to 100.9	99.3 to 100.7
2	1000Ω	992 to 1008	994 to 1006
3	10 kΩ	9.92 to 10.08	9.94 to 10.06
4	100 kΩ	99.2 to 100.8	99.4 to 100.6
5	1 MΩ	.992 to 1.008	.994 to 1.006
6	10 MΩ	9.74 to 10.26	9.79 to 10.21

Table 4-5. DC mA Test

STEP	INPUT CURRENT	DISPLAY READING
1	+27 mA	26.58 to 27.43
2	+200 mA	195.8 to 204.2

Table 4-6. DC Amps Test (23 Only)

STEP	INPUT CURRENT (5100B)	DISPLAY READING
1	+1.99999A dc	1.95 to 2.05

4-14. CALIBRATION

1. Set the DC Voltage Calibrator to zero and set the UUT to the VDC function.

2. Connect the DC Voltage Calibrator to the V-Ohm and Common input terminals of the UUT.

3. Set the DC Voltage Calibrator for an output of +3V dc and adjust R8 for a display reading of +3.000V dc ± .001V.

4-15. TROUBLESHOOTING

A fault guide for the 21, 23 Multimeters is given in Table 4-7. This guide can be helpful in isolating troubles to a component area. Also, procedures are given below to help isolate the troubles further. In these procedures, the 21, 23 Multimeters are referred to as the unit under test (UUT).

When troubleshooting 21, 23 Multimeters, use the precautions listed on the static awareness sheet to prevent damage from static discharge.

4-16. Overall System Check

Make the following checks in the order listed. All measurements are made with respect to common.

1. Put the UUT function switch in the VDC position.

2. Using a DVM, check +VDD (TP-1) or the positive battery post for 3.1V dc ± .1V.

   Probable failure: BT1, CR1, U1, loose battery connector

3. Connect an oscilloscope or counter to pin 54 of U1 or to the junction of C12 and Y1 crystal. Check for a 32.768 kHz sine wave approximately 600 mV p-p in amplitude. Note that U2 and the display will not work if the clock circuit is not working.

   Probable failure: U1, Y1, or C12

4. Check for a reference voltage of 1.00V dc (adjustable by R8) at pin 14 of U1 or the junction of R15 and R16.

   Probable failure: R8, R14, R15, R16, VR1, or CR2

5. Check that VM (V middle) is 1.6V dc ± .1V at pin 28 of U2 or at the junction of R11 and R12.

   Probable failure: R11, R12 or C10

4-17. VDC Signal Tracing

Make the following checks in the order listed. All measurements are made with respect to common.

1. Put the UUT in the VDC function and apply 2V dc to the input.

2. Using a DVM, measure the input at J1 for 2V dc.

3. Measure pin 1 of Z1 input divider for 2V dc.

   Probable failure: R1, S1, E1, RJ1

WARNING

R1 AND R20 ARE FUSIBLE RESISTORS. TO ENSURE SAFETY, USE EXACT REPLACEMENT ONLY.

NOTE

Measurements in steps 4, 5, and 6 may be affected by loading.

4. Measure Z1 pin 3 for 200 mV dc.

   Probable failure: Z1, U1

5. Measure for 200 mV dc at the active filter input (AFI, pin 26 of U1 or R9).

   Probable failure: U1

6. Measure for 200 mV at the active filter output (AFO, pin 27 of U1 or R9).

   Probable failure: R9, C5 or C6

Table 4-7. Fault Guide

SYMPTOM	ACTION	POSSIBLE COMPONENT
Blank display	Follow overall system check (paragraph 4-16)	BT1, U1, U2, Y1, CR1, C12
Display reads zero in volts function	Trace DC signal (paragraph 4-17)	E1, R1, Z1, R9, RJ1, U1, S1
Display hangs up in power-up self test (see Figure 4-2)	Follow overall system check (paragraph 4-16)	R14, R8, R15, R16, VR1, C7, C8, Z1, CR2, U1
Display reads OL or zero in 300mA		R13, U1
Display reads zero in 300mA or 10A current ranges		F1, F2, or F3 R20,R6,R5,R7,R13
AC volts is not accurate		R17 & R18
Display reads OL in 300mV range		Q3 shorted, U1
AC volts noisy at 50 to 60 Hz		R9, R10, C5, C6
Display has wrong annunciator called	Check Table 3-1 for correct codes	S1 REAR, U1
Volts inaccurate		Check calibration
Ohms inaccurate		Z1, U1
Intermittent display	Clean connectors and connector strips of the LCD and pwb	Display assembly
Display reads constant offset in volts		C5, C6, or C7 shorted
Ohms reads low or won't read OL		Q1 or Q2 shorted or leaky, E1, E2, RJ1
Ohms reads randomly or flashes between on-scale and OL		R1, RT1

Section 5
List of Replaceable Parts

5-1. INTRODUCTION

This section contains an illustrated parts breakdown of the 21, 23 Multimeters. Both electrical and mechanical parts are listed alphanumerically by reference designator or item number. Each listed component is shown in an accompanying illustration unless otherwise noted.

Parts lists include the following information:

1. Reference designation or item number
2. Description of each part
3. Fluke part number
4. Total quantity per instrument model

5-2. HOW TO OBTAIN PARTS

Components may be ordered from John Fluke Mfg. Co., Inc. factory or authorized representative listed in the Operator's Manual by using the FLUKE PART NUMBER. In the event the part your order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

To ensure prompt and efficient handling of your order, include the following information:

1. Quantity
2. Fluke part number
3. Description of part
4. Printed wire board (pwb) part number and revision letter as printed in ink on the board.
5. The reference designation or item number of the part.
6. Instrument model and serial number.

When servicing, use only specified replacement parts.

Table 5-1. 21, 23 Final Assembly

REF DES ITEM NO.	DESCRIPTION	FLUKE PART NO.	TOTAL QTY WHERE USED 21	23
(not shown)	Case Assembly, Top	753434	0	1
(not shown)	Case Assembly, Top	753426	1	0
(not shown)	Case Assembly, Bottom	764654	1	0
(not shown)	Case Assembly, Bottom	764662	0	1
106	Transducer	642991	1	1
107	Contact, Annunciator	642983	1	1
111	Spring, Coil	697227	1	1
116	Screw, Thread forming	519116	1	1
206	Window, LCD	748145	0	1
206	Window, LCD	748137	1	0
207	Bracket, LCD	646653	1	1
208	Mask, Bracket	642090	1	1
209	Connector, LCD to PWB	649632	2	2
216	Screw, Thread forming	448456	4	4
241	Screw, Thread forming	733410	4	4
246	Foot, Non skid	640565	4	4
301	Decal	749085	0	1
301	Decal	749069	1	0
(not shown)	Manual, Operator's	749093	1	0
(not shown)	Manual, Operator's	753368	0	1
(not shown)	* Test leads, one set	TL70	1	1
(not shown)	* Holster	C70	0	1
(not shown)	* Alligator clip set, 2 red, 2 black	AC70	1	1
(not shown)	Holster bail assembly	680652	0	1
(not shown)	Battery contact, female	654228	1	1
(not shown)	Battery contact, male	642967	1	1

* May be ordered as an accessory. Order from distributor or local representative.

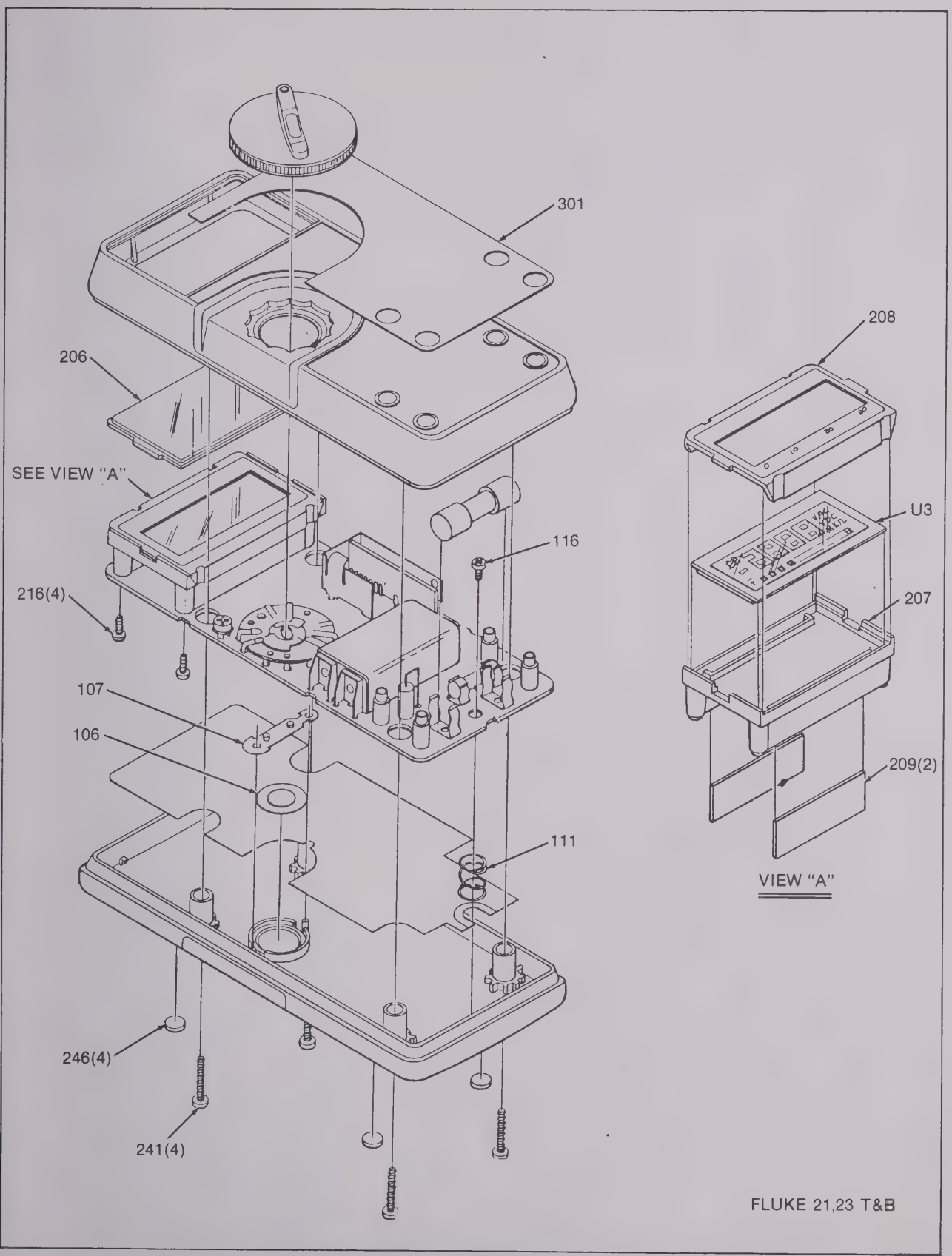
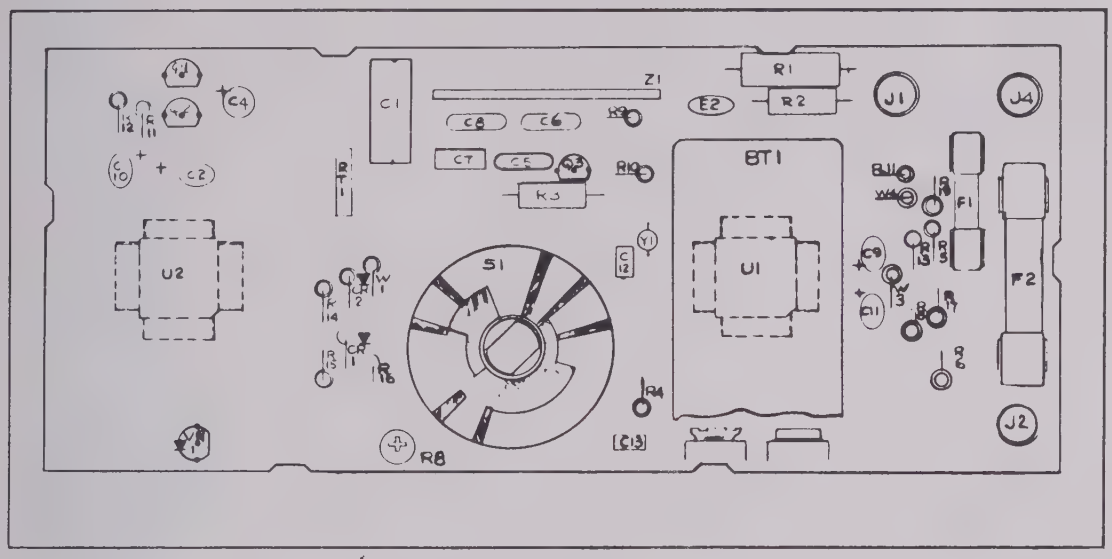


Figure 5-1. 21, 23 Final Assembly

Table 5-2. 21, 23 PWB Assembly

REF DES ITEM NO.	DESCRIPTION	FLUKE PART NO.	TOTAL QTY WHERE USED 21	23
BT1	Battery, 9 Volt	696534	1	1
C1	Cap, .022 uF, 1000V	721019	1	1
C2,C10	Cap, .47 uF, 35V, 20%	655035	2	2
C4	Cap, 2.2 uF, 50V, 20%	650069	1	1
C5,C6	Cap, .027 uF, 50V, 10%	720979	2	2
C7	Cap, .47 uF	697409	1	1
C8	Cap, .033 uF, 50V, 5%	721050	1	1
C9	Cap, 6.8 uF, 10V, 20%	655043	1	1
C11	Cap, 2.2 uF, 16V, 20%	706804	1	1
C12	Cap, 47 pF, 50V, 20%	706705	1	1
C13	Cap, .22 uF, 50V, 20%	649939	1	1
C14,C15	Cap,cer,33 pF, +/-5%,50V, COG	714543	2	2
CR1,CR2	Diode, 1N4448	659516	2	2
E1,E2	Spark Gap	655134	1	2
F1	Fuse, 630 mA, 250V 1500A Interrupt Rating, IEC 127/II, 5x20 mm	740670	1	1
F2	Fuse, Fiber, 20A, 600V	756601	1	0
F3	Fuse, Fiber, 15A, 600V	820829	0	1
Q1,Q2	Xstr, SI, NPN, Small Signal	698225	2	2
Q3	Xstr, SM Signal	685404	1	1
R1	* Res, Fixed, 1k, WW Fusible 2W	650085	1	1
R2,R3	Res, Fixed Cermet 1M,1W,5%	655175	2	2
R4	Res, 100k, 1/4W, 5%	658963	1	1
R5	Res, 390k, 1/4W, 5%	706754	0	0
R5	Res, 402k, 1/4W, .25%	706739	1	1
R6	Res, Fixed, 4.99,1% +/-50 ppm	655019	1	1
R7	Res, Fixed, .005,1% +/-50 ppm	740415	0	1
R8	Res, Var, 100k, 20%	649897	1	1
R9,R19	Res, 1M, 1/4W, 5%, CF	649970	2	2
R10	Res, 1.5M, 1/4W, 5%, CF	649962	1	1
R11	Res, 332k, 1/8W, 1%	655217	1	1
R12	Res, 301k, 1/8W, 1%	655274	1	1
R13	Res, 44.8k, 1/8W, .25%	706747	1	1
R14	Res, 62k, 1/4W, 5%, CF	713941	1	1
R15	Res, 56.2k, 1/8W, 1%	706242	1	1
R16	Res, 205k, 1/8W, 1%	706234	1	1
R17	Res, 20.5k, 1/8W, 5%	682716	1	1
R18	Res, 9.20k, 1/8W, 5%	715219	1	1
R20	* Res,Fixed,0.36,WW,Fusible, 2W	740662	0	1
RJ1	MOV, 1200V, 10%	756569	1	0
RJ1	MOV, 1200V, 10%	706838	0	1
RT1	Res, Thermistor, PTC 1k	446849	1	1
S1	Switch, Rotary	642918	1	1
U1	A/P 75	683052	1	1
U2	Microcomputer, CMOS 4-Bit	659656	1	1
U3	LCD	640581	1	1
VR1	Voltage Ref, 1.23V	729202	1	1
W1	Res, zero ohm	682575	1	0
W2	Res, zero ohm	682575	0	1
Y1	Crystal, 32.768 kHz	643031	1	1
Z1	Res, network	616870	1	1

* WARNING--FUSIBLE RESISTOR. TO ENSURE SAFETY, USE EXACT REPLACEMENT ONLY.



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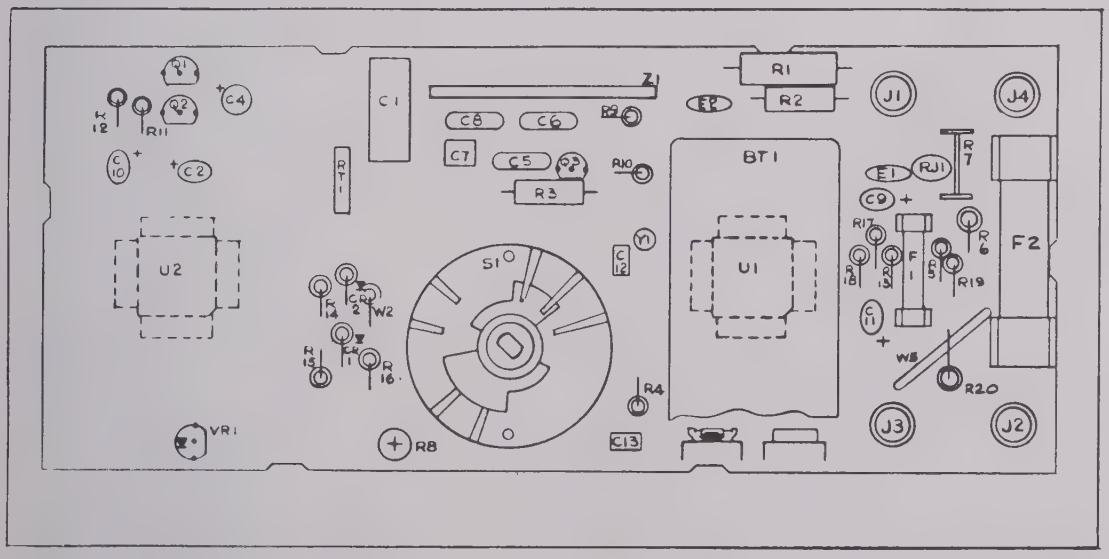

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Figure 5-2. 21, 23 PWB Assembly

Section 6
List of Abbreviations

6-1. INTRODUCTION

This section contains a list of definitions for abbreviations used in the schematic drawings for the 21, 23 Multimeters.

Table 6-1. Abbreviations

ABBREVIATION	DEFINITION
ACA	AC Converter Feedback
ACHI	AC Converter High
ACL	All Clear, Reset
ACLO	AC Converter Low
AFI	Active Filter Input
AFO	Active Filter Output
AMO	Amps Input
AM1	Amps Divide by 10
AZ	Auto Zero Point
BPR	Beeper Driver
BT	Battery
CLK	Clock Output
COM	Common
DCS	DC Sense
EC	Reference Voltage

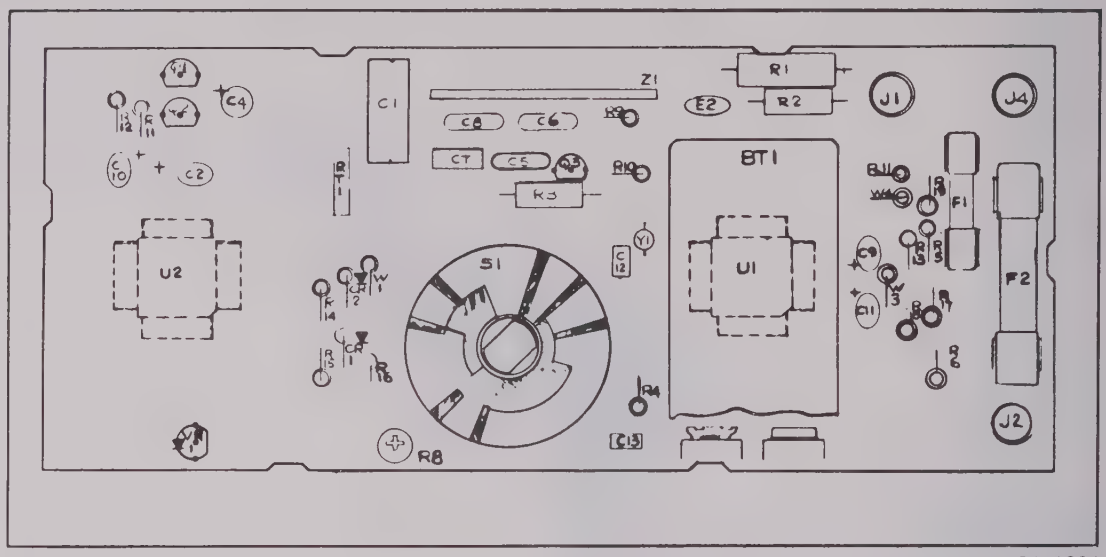
Table 6-1. Abbreviations (cont)

ABBREVIATION	DEFINITION
FAO	Active Filter Amp Output
FA(-)	Active Filter Amp Feedback
INT	Integrator Output
K0	Buffer Divide By 1 Output
K1	Buffer Divide by 3 Output
LS	Loud Speaker
LO	Low
OHS	Ohms Sense
RNG	Range
RRS	Reference Resistor Sense
RT	Thermistor
VSS	Negative Supply Voltage
VDD	Positive Supply Voltage
VM	Volts Middle
WW	Wirewound
XTL	Crystal Oscillator Inputs
Z	Impedance

Section 7
Schematic Diagram

7-1. INTRODUCTION

This section presents a schematic diagram for the Fluke 21, 23 Multimeters. Differences between the models are noted.



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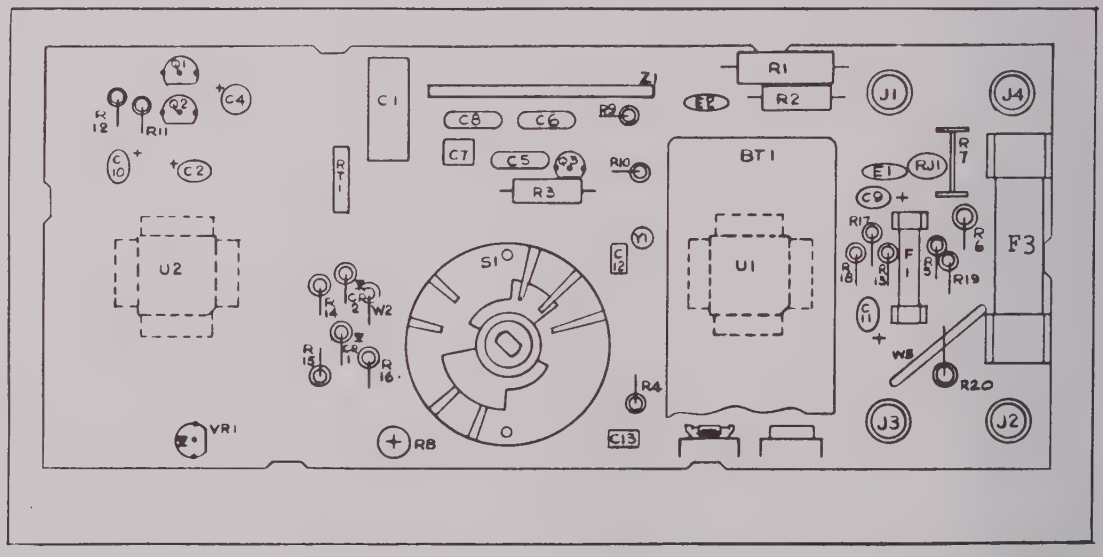

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Figure 7-1. A1 Main PWB Assembly (cont)

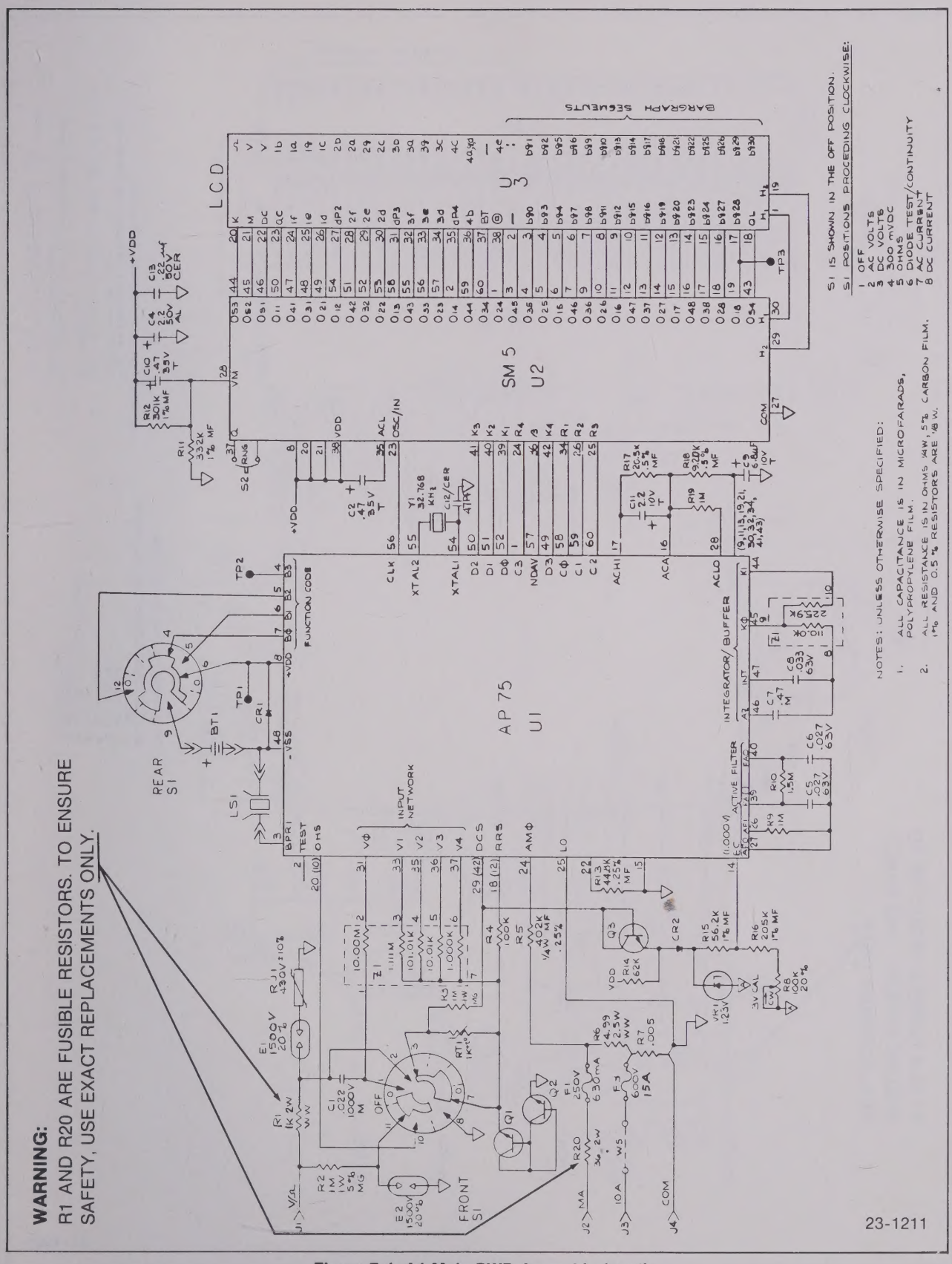


Figure 7-1. A1 Main PWB Assembly (cont)

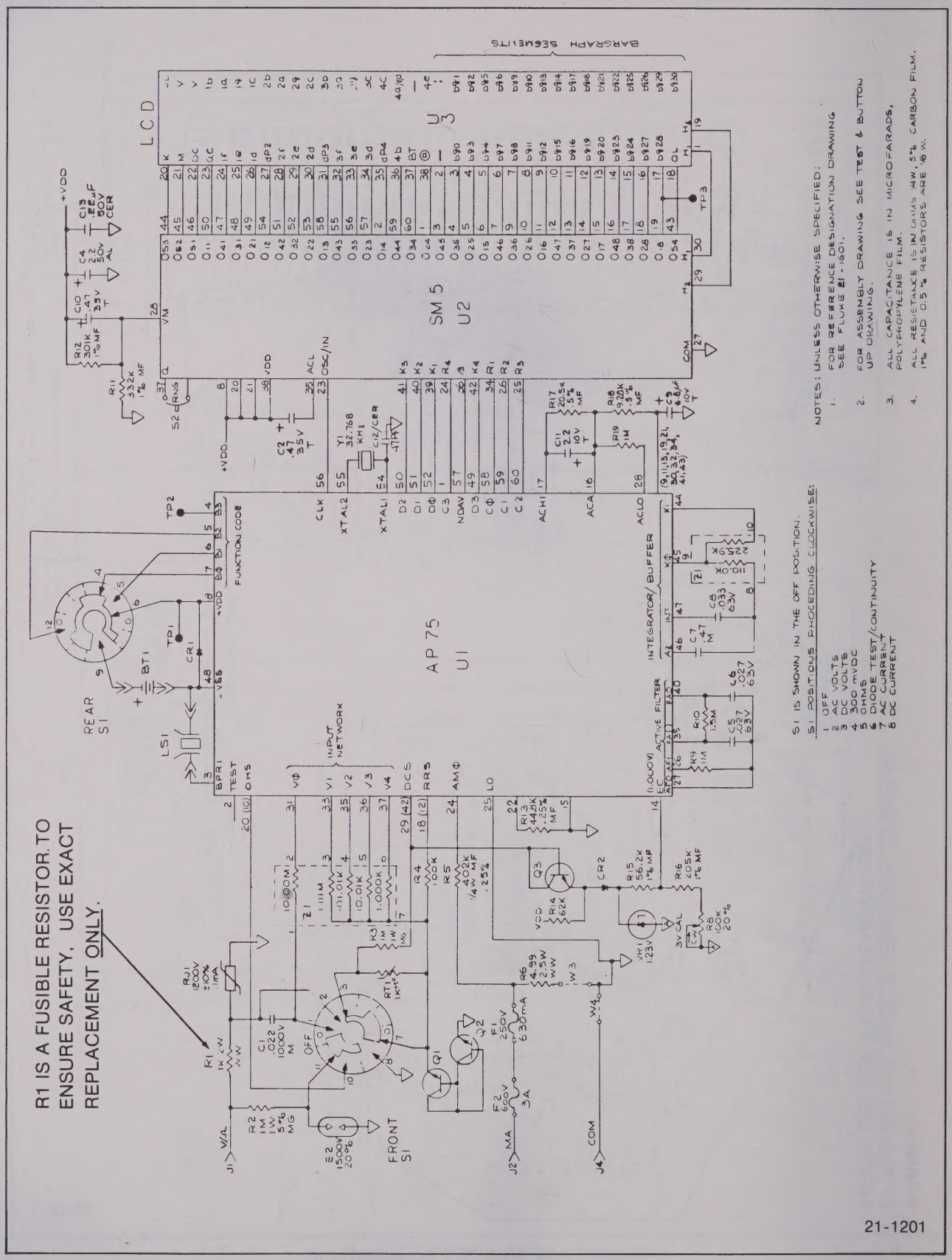
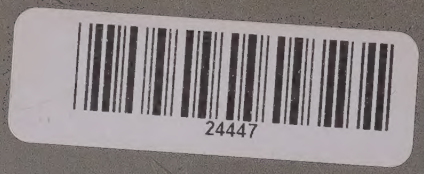


Figure 7-1. A1 Main PWB Assembly (cont)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